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By-Hogan, Robert; Greenberger, Ellen

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REPORT No. 32

THE CENTER FOR THE STUDY OF SOCIAL ORGANIZATION OF SCHOOLS

DEVELOPMENT OF A CURIOSITY SCALE

ROBERT HOGAN

AND

ELLEN GREENBERGER

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DEVELOPMENT OF A CURIOSITY SCALE[1]

Project No. 61610-03-08

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Robert Hogan and Ellen Greenberger

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Abstract

This report describes the development of a brief adjective check-list measure of curiosity. This check list, designed to be used with elementary school children, is empirically-keyed and contains a built-in check for rater bias. From an initial pool of 40 adjectives judged relevant to curiosity, a final set of 30 were selected after two item analyses using behavioral indices of curiosity. Evidence is presented which suggests that the scale defines a unitary dimension and yields valid rank-orderings for curiosity when used by a single teacher in a classroom. Evidence concerning the relationship between curiosity and standardized measures of intelligence and academic achievement is also presented.

Because standardized intelligence measures do not adequately sample the full range of important cognitive variables, investigators have increasingly turned to other aspects of intellectual performance such as creativity (MacKinnon, 1962), preference for complexity (Barron, 1952), social intelligence (Chapin, 1942; Gough, 1965), and associative response hierarchies (Mednick, 1962; Entwisle & Greenberger, 1968). Another cognitive variable of potential significance for academic and "real-world" performance is curiosity, several discussions of which have recently appeared (e.g., Berlyne, 1963; Day, 1968; Maw & Maw, 1962; Penney & McCann, 1964). Curiosity may be broadly defined as "openness to unusual experience...the desire to understand novel experience and incorporate it into one's map of the world" (Beswick, 1965). In terms of earlier research, this is a definition of diversive rather than specific curiosity; i.e., it defines curiosity as a "systems" variable, a general cognitive disposition which is independent of specific organismic arousal states. Obviously an understanding of the origins and development of curiosity, especially an understanding of the manner in which curiosity may be fostered and encouraged, is of considerable interest. Systematic study of curiosity, however, depends on the availability of valid and reliable measures of the concept. This paper reports one attempt to create such a measure. Alternative approaches are also under development (Greenberger, 1969a and 1969b, forthcoming).

The authors were concerned primarily with investigating curiosity in early grade school children. Such a population presents special measurement problems because traditional paper and pencil performance

tests and self-report scales are not applicable. One alternative is to conduct individual clinical interviews in the manner of Piaget. However, such procedures are time-consuming and costly, thereby making the development of briefer and less expensive measurement methods highly desirable.

A second strategy is to capitalize on the knowledge of seasoned observers who have had extended experience with the children in question. Specifically, this involves developing a rating form for curiosity to be used by teachers. Although such a procedure may have obvious face validity, it may also be highly susceptible to the familiar problem of rater bias or "halo effect." However, if such biases are assumed to operate at all times, then certain steps can be taken to modify their net effect. With these considerations in mind, a rating device for curiosity in the form of a brief adjective check list was developed which is quick and easy to use, and is keyed to minimize the influence of rater bias.

To select items for the checklist, twelve students in a personality assessment course (graduate students and senior psychology majors at The Johns Hopkins University) were asked by Hogan to describe their conceptions of a highly curious child using the Gough Adjective Checklist (Gough, 1960; Gough & Heilbrun, 1964). The responses of these judges were recorded and tallied, and 30 adjectives characteristic of the curious child were selected for which there was at least 75% agreement. The judges showed perfect agreement on seven adjectives: active, adventurous, curious, energetic, enthusiastic, imaginative, interests wide. Eleven of the 12 judges agreed on six adjectives: alert,

assertive, clever, enterprising, intelligent, and restless. Ten of the 12 agreed on eight adjectives: aggressive, changeable, impulsive, individualistic, initiative, inventive, mischievous, and quick. Finally, nine of the 12 judges agreed on nine items: daring, demanding, determined, impatient, independent, persistent, resourceful, spontaneous, and talkative. The thirty adjectives just listed (7+6+8+9) were considered as an initial curiosity-positive scale.

Next, the judges selected 10 items with complete agreement as contra-indicative of the curious child: apathetic, dull, fearful, meek, quiet, shy, simple, timid, whiny, and withdrawn. These 10 items were considered as a curiosity-negative scale.

Finally, Hogan chose, on the basis of general experience with halo effect, a set of 10 adjectives indicative of social desirability: affectionate, cheerful, considerate, cooperative, good-natured, helpful, mannerly, stable, unselfish, and wholesome. These items, considered a halo scale, were added in part to disguise the purpose of the checklist, and in part as a check for rater bias, i.e. a rough analogue to the MMPI K scale.

This set of 50 adjectives, representing the initial item pool, was assembled in the format shown in Table 1. Adjectives were scored + 1 if checked; 0 if unchecked. The score for each subscale is the sum of these unit weights. The total curiosity score is found by the formula

$$\text{Curiosity} = \text{Curiosity positive} + (10 - \text{Curiosity negative})$$

which is used to insure that the curiosity score will always be a positive number.

As part of a study conducted by Greenberger (1969a and 1969b, forthcoming), the checklists were then filled out by teachers of 2 kindergarten classes (N=44) and 2 second-grade classes (N=52). All children came from middle and upper middle class neighborhoods, with the kindergarten children probably standing slightly higher on SES variables than the second-graders.

Items for the final scale were selected on the basis of 3 item analyses performed separately for each of the subscales.

First, for the two age levels of children, adjectives on each scale were inter-correlated, and correlated with the total score for that scale. Phi coefficients indicating the relationship between each adjective and the total score for its respective subscale are reported in Tables 2 & 3; in these tables Phi is adjusted to be a proportion of its maximum value. The matrix of item inter-correlations is not reproduced, but the Phi values are generally sizable and large with the exception of the adjective "changeable." On the basis of this first analysis, 3 items were dropped from the curiosity-poitive subscale because of low correlations with total score on the scale (changeable, clever, and mischievous).

The second and third item analyses examined the external validities of the items. The second analysis was performed on the data from the kindergarten sample (N=44). Here each adjective was correlated with scores on the Incongruous Picture Choices procedure (Greenberger, 1969a). In this procedure, 14 pairs of pictures are presented one at a time. Each pair contains a "normal" and an "incongruous" picture which are alike except for the incongruous detail. The child is asked to indicate

which one he would like to know more about. His score is the number of incongruous choices he makes. Correlations between the adjectives and Incongruous Picture Choices are given in Tables 4 and 5.

The third item analysis used 27 students drawn from one second grade class. In this analysis each adjective was correlated with scores on the Incongruity Game (Greenberger, 1969a and b). This is a measure of interest in incongruity and persistence in its resulution. The score is based on the number of times a child wishes to hear more about an incongruous (vs. normal) picture and his persistence in obtaining this information. Correlations with the Incongruity Game are also presented in Tables 4 and 5.

The results of the second and third analyses were examined simultaneously, and 7 items were dropped from the curiosity-positive subscale because of low external validity (alert, enterprising, impulsive, initiative, intelligent, quick, and restless).

Through these three analyses, sets of 20 adjectives indicative and 10 adjectives contra-indicative of curiosity were obtained, along with a third set of 10 adjectives representing socially desirable traits conceptually unrelated to curiosity. (As reported below, the halo scale is uncorrelated with the curiosity subscales.) All subscales have a high degree of homogeneity (KR 20 reliabilities $\geq .90$), thereby suggesting that they define reasonably unitary dimensions.

Table 6 shows the relationships between the initial and final positive subscales, the negative subscale, total scores based on these scales, and the halo scale. For purposes of convenience, these correlations were computed for an all male-sample; similar figures also

obtain for girls. A close reading of Table 6 shows that shortening the curiosity positive scale has increased its correlation with the negative subscale and the total score, indicating that the reliability of the total curiosity score has been improved. Furthermore, the curiosity subscale shows a gratifyingly low correlation with the halo subscale.

Thus far the discussion has been concerned with origins and internal psychometric properties of the curiosity scale. We should inquire next about the validity of the scale. There are 4 lines of evidence bearing on this topic. The first comes from the kindergarten sample, where for 44 students from two classes, the average correlation between curiosity scale scores and an Incongruous Pictures procedure, a behavioral index of curiosity, was .421, $p < .01$.

The second piece of evidence comes from 37 students in the second grade. Here the behavioral indices of curiosity are scores for the Incongruity Game. The correlation between curiosity scale scores and scores from the Incongruity Game was .21. While not statistically significant, this correlation is in the proper direction. However, the sample is too small for any valid generalization to be drawn.

The third line of evidence for the validity of the curiosity scale is in the form of convergent validity. Data for this sample were collected using Greenberger's Student Behavior Profile (Greenberger, 1969a, forthcoming). This is a teacher's rating form utilizing 9-point scales for rating curiosity, need for achievement, and achievement blocks.

Correlations between these measures and the curiosity scale are offered in Table 7. From this data it is apparent that curiosity scores accord well with other similarly derived indices of the same phenomenon. However, the correlations in Table 7 are to some degree inflated by method variance. Unfortunately it is not possible to separate trait from method variance here by use of methods such as those suggested by Stanley (1961) because each subject has been rated by only one rater. Thus this data should be interpreted as showing some relationship between the curiosity scale and alternative measures of the same construct, the true magnitude of which is yet to be determined. Given these qualifications, the fact remains that correlations in Table 7 are sizable and impressively consistent across age, sex, and rater. Furthermore, all correlations are in a theoretically meaningful direction. One of the more interesting auxiliary pieces of information in Table 7 is that rated need achievement is highly correlated with the halo subscale, suggesting a considerable social desirability component in the variable popularized by McClelland, et al (1953).

The fourth line of validational evidence regards the relationship between curiosity scores and standard indices of academic potential and achievement. This information, obtained as part of the Greenberger (1969a and b) studies, is offered in Table 8. These correlations suggest that curiosity plays a larger role in actual academic achievement than it does in conventional classroom effort, and that curiosity is moderately related to I.Q. scores. Thus bright children tend to be curious and tend to perform well in school. On the surface this is hardly an unexpected finding, yet by its nature it increases our confidence in

the validity of the curiosity scale. By itself, however, the correlation coefficient oversimplifies the actual nature of the relationship between curiosity and intelligence.

An examination of the bivariate plot for curiosity and intelligence reveals a pear-shaped (or perhaps triangular) distribution similar to that reported by Hoepfner and O'Sullivan (1968) for the relationship between social intelligence and I.Q. Thus if a child has a high score for I.Q., he will almost certainly have a high curiosity score. On the other hand, if the child has an average to low I.Q. score, his curiosity score is not predictable, and may be either high or low depending on other unknown factors. An interesting question then arises as to whether the determinants of curiosity are the same for different points on the I.Q. continuum. Such questions, of course, can only be answered by further research.

Discussion

With regard to the mechanics of this measure, one might question its objectivity since it relies on the personal and intuitive judgments of teachers. However, the correlations with other behavioral measures (incongruous choices, interest and persistence in resolving incongruity, standardized test scores) suggest that a few rapid judgments which systematically sample variables relevant to curiosity and weight them in a consistent fashion can produce valid, meaningful scores.

Scores on the curiosity scale derived from descriptions provided by a single teacher give only a rank ordering for curiosity within a single classroom. Fortunately, however, as Block (1961, p.38) has

shown for a related procedure, as the number of judges contributing descriptions increases, the reliability (and hence the accuracy) of the resulting composite scores increases very quickly. Thus composite curiosity scores will quickly approach a stable linear ordering as the number of judges goes up. Therefore, if one is concerned with discovering an estimate of the "true" curiosity score for a child, this may be obtained by gathering descriptions from several judges, averaging them, and converting them to a standard score. For most classroom diagnostic purposes, however, estimates provided by a single teacher appear to be valid for comparisons within a single class.

It should also be noted that work is underway to determine the validity of the curiosity scale for use with other than white, middle-class samples. This data will be reported at a later time.

There are interesting parallels and contrasts between the data presented in this paper and earlier investigations of curiosity. First, previous studies (i.e., Day, 1968; Penney & McCann, 1964) found no significant relationship between curiosity and standardized measures of intelligence. In contrast, the data presented here show moderate but persistent correlations with I.Q. and academic achievement. How might these discrepancies be explained? Part of the answer undoubtedly lies in differences in the populations and measures employed. But a more interesting possibility is that the differences reflect a true state of nature, i.e., that the correlation between I.Q. and curiosity in fact declines over time as some curious children (for a variety of reasons) inhibit their curiosity. Indeed, that something like this happens is part of the conventional wisdom of our time; such a trend

is given explicit recognition in Jung's observation "les savants ne sont pas curieux."

Second, in a related study, Maw and Maw (1962) found that 5th grade students nominated by teachers and peers as high in curiosity were more interested in hearing about unusual designs and symbols than students rated low in curiosity. This agrees nicely with our finding that curiosity scores were positively related to choosing unusual over normal pictures (Incongruous Pictures Procedure) and to an interest in hearing about unusual pictures (the Incongruities Game).

Third, Penney (1965) found that scores on his Reactive Curiosity Scale were negatively related to scores on the Children's Manifest Anxiety Scale (Castenada, McCandless, & Palermo, 1956). In the present paper, the curiosity-negative subscale shows the same relationship as the Children's Manifest Anxiety Scale to curiosity, and in fact can be viewed as a symptom checklist for manifest anxiety. The negative association between curiosity and anxiety may be interpreted as showing either that anxious children are, for other reasons, also less curious, or that anxiety causes children to inhibit overt expressions of curiosity. Work with lower animals (e.g., Harlow, 1958) has shown that the latter is a distinct possibility. The point to be made here, however, is that there is full agreement between Penney's paper and this report concerning the relationship between curiosity and anxiety.

TABLE 1

Initial Curiosity Checklist

Confidential

Activities Checklist

Student's name _____ Teacher's name _____

School: _____ Date: _____

Directions: This sheet contains a list of adjectives. Please read them quickly and put an X in the circle beside each one you consider to be descriptive of the student under observation. Work quickly, and do not spend too much time on any one adjective.

0 active 1	0 demanding 15	0 initiative 29	0 spontaneous 43
0 adventurous 2	0 determined 16	0 intelligent 30	0 stable 44
0 affectionate 3	0 dull 17	0 interests wide 31	0 talkative 45
0 aggressive 4	0 energetic 18	0 inventive 32	0 timid 46
0 alert 5	0 enterprising 19	0 mannerly 33	0 unselfish 47
0 apathetic 6	0 enthusiastic 20	0 meek 34	0 whiny 48
0 assertive 7	0 fearful 21	0 mischievous 35	0 wholesome 49
0 changeable 8	0 good-natured 22	0 persistent 36	0 withdrawn 50
0 cheerful 9	0 helpful 23	0 quick 37	
0 clever 10	0 imaginative 24	0 quiet 38	
0 considerate 11	0 impatient 25	0 resourceful 39	
0 cooperative 12	0 impulsive 26	0 restless 40	
0 curious 13	0 independent 27	0 shy 41	
0 daring 14	0 individualistic 28	0 simple 42	

TABLE 2

Phi Coefficients (Items vs. Total Score) for
Curiosity-Positive Adjectives from the Curiosity Scale

	Kind.	2nd gr.		Kind.	2nd gr.
1. active	.91	.81	16. impatient	.83	.83
2. adventurous	.82	.93	17. impulsive	.81	.76
3. aggressive	1.00	.63	18. independent	.49	.46
4. alert	.72	.67	19. individualistic	.91	.76
5. assertive	1.00	.76	20. initiative	.81	.75
6. changeable	.45	.04	21. intelligent	1.00	.77
7. clever	.53	.60	22. interests wide	.47	.74
8. curious	.67	.83	23. inventive	.64	.53
9. daring	.86	.89	24. mischievous	.40	.42
10. demanding	.81	.83	25. persistent	.64	.52
11. determined	.70	.70	26. quick	.86	.75
12. energetic	.91	.65	27. resourceful	.88	.56
13. enterprising	.69	.68	28. restless	.70	.70
14. enthusiastic	.75	.74	29. spontaneous	.89	.44
15. imaginative	.49	.65	30. talkative	.70	.54

N = 96

TABLE 3

Phi Coefficients (Items vs. Total Score) for Halo Adjectives and Curiosity Negative Adjectives from the Curiosity Scale

Negative Adjectives	Kinder-garten	Second Grade	Halo Adjectives	Kinder-garten	Second Grade
1. apathetic	1.00	1.00	1. affectionate	.43	.36
2. dull	1.00	1.00	2. cheerful	1.00	.57
3. fearful	.12	.85	3. considerate	1.00	.93
4. meek	1.00	.83	4. cooperative	1.00	.93
5. quiet	.69	.59	5. good-natured	1.00	.93
6. shy	.90	.88	6. helpful	1.00	.79
7. simple	.19	1.00	7. mannerly	.78	.93
8. timid	1.00	.88	8. stable	.60	.36
9. whiny	1.00	.06	9. unselfish	.72	.93
10. withdrawn	.78	1.00	10. wholesome	.53	.93

N = 96

TABLE 4

Correlations Between Curiosity-Positive Adjectives and Behavioral Indices of Curiosity

ADJECTIVE	SAMPLE: KINDERGARTEN[a]	SAMPLE: 2ND GRADE[b]	ADJECTIVE	SAMPLE: KINDERGARTEN[a]	SAMPLE: 2ND GRADE[b]
1. Active	.10	.38	16. Impatient	.17	.17
2. Adventurous	.15	.31	17. Impulsive	-.08	.16
3. Aggressive	.25	.17	18. Independent	.17	.30
4. Alert	.11	.05	19. Individualistic	.00	.51
5. Assertive	.15	.27	20. Initiative	.00	.12
6. Changeable	-.36	-.01	21. Intelligent	.00	.08
7. Clever	.08	.20	22. Interests Wide	.17	.17
8. Curious	.09	.42	23. Inventive	.23	.09
9. Daring	.23	.27	24. Mischievous	.15	.10
10. Demanding	-.09	.30	25. Persistent	.23	-.03
11. Determined	.31	.31	26. Quick	-.09	.06
12. Energetic	-.15	.32	27. Resourceful	.10	.18
13. Enterprising	-.25	.28	28. Restless	-.18	.05
14. Enthusiastic	-.10	.50	29. Spontaneous	-.08	.39
15. Imaginative	.08	.22	30. Talkative	.15	.26

a: N= 44
b: N= 28

TABLE 5

Correlations Between Curiosity-Negative Adjectives, Halo Adjectives, and Behavioral Indices of Curiosity

Negative Adjectives	Sample		Halo Adjectives	Sample	
	Kindergarten[a]	2nd Grade[b]		Kindergarten[a]	2nd Grade[b]
1. Apathetic	.00	-.22	1. Affectionate	-.08	.47
2. Dull	.00	-.04	2. Cheerful	.11	.34
3. Fearful	.20	-.30	3. Considerate	-.08	.10
4. Meek	.00	-.24	4. Cooperative	.00	-.31
5. Quiet	-.08	-.17	5. Good-Natured	.00	-.06
6. Shy	-.15	-.36	6. Helpful	.17	.01
7. Simple	.23	-.31	7. Mannerly	.00	-.26
8. Timid	-.25	-.21	8. Stable	.31	.00
9. Whiny	-.20	.01	9. Unselfish	.08	-.10
10. Withdrawn	-.11	-.25	10. Wholesome	.00	.19

[a] $N = 44$

[b] $N = 28$

TABLE 6

Correlations Between Various Subscales and Total Scores for the Curiosity Scale

	Initial Curiosity Positive	Initial Total Score	Final Curiosity Positive	Final Total Score	Curiosity Negative	Halo
Initial Curiosity Positive	--					
Initial Total Score	.99	--				
Final Curiosity Positive	.99	.98	--			
Final Total Score	.97	.99	.99	--		
Curiosity Negative	-.61	-.80	-.68	-.82	--	
Halo	-.12	-.12	-.08	-.08	-.02	--

N = 96

TABLE 7

Correlations Between Curiosity Scale, Halo Subscale and Related Measures

Rating Scales	Curiosity		Halo	
	Kinder-garten[a]	Second Grade[b]	Kinder-garten[a]	Second Grade[b]
1. Beswick Curiosity	.74	.75	.37	.08 N.S.
2. Overt Curiosity	.83	.77	.20 N.S.	-.05 N.S.
3. Greenberger Curiosity	.56	.68	.37	.07 N.S.
4. Rated N Achievement	.52	.24 N.S.	.51	.56
5. Blocking	-.58	-.33	-.22 N.S.	-.34

[a] N = 44

[b] N = 52

N.S. = Not significant at or beyond the .05 level.

TABLE 8

Correlations Between Curiosity Scale, Halo Subscale, I.Q. Scores, Grades, and Classroom Effort

	Curiosity	Halo
1. Reading Grade[a]	.32*	.20
2. Reading Effort[a]	-.18	.44**
3. Arithmetic Grade[a]	.47**	.21
4. Arithmetic Effort[a]	-.35*	.34*
5. I.Q.[b]	.36**	.23*

[a] N = 37 * $p \leq .05$

[b] N = 80 ** $p \leq .01$

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